Momentum Strategy Performances in New Energy Vehicle Industry

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Abstract. The automotive industry is now actively working toward the strategic goal of developing new energy vehicles (NEVs). As a common strategy, momentum strategy is suitable for variation stocks. On this basis, this article focuses on new energy vehicle stocks and explores some variations of the current momentum strategies. This article provides proof that the momentum strategy exists in a certain stock. The sensitivity of the strategy return to stock market volatility will vary with varied lengths of lookback periods. The affected Sharpe ratio of the strategy shows that the transaction cost has some impact on the return of the momentum approach. Given that fossil fuels are being replaced by new energy sources today, research into NEV manufacturers is worthwhile. The significance of this research is providing a greater understanding of momentum strategy and investigating its feature in real data. These results shed light on guiding further exploration of implementations and applications of momentum strategy.

Keywords: New energy vehicle; Momentum strategy; Performances; Stock.

1. Introduction

A momentum strategy is a type of trading approach used by investors while transacting on the stock market. According to Chabot, Eric and Ravi [1], since the Victorian era, researchers have found consistent momentum trends in the stock market (ca. 1830s to 1900) [2]. The momentum strategy was introduced by Jegadeesh and Titman in 1993 [3], who suggested that investors use a momentum strategy in the stock market to obtain an abnormal return. Nearly a decade later, their original results remained equally valid in the following years after their first publication [4]. By putting and buying groups of excellent stocks and selling non-winning stock portfolios, investors might achieve an abnormal return. Numerous other scholarly investigations, some dating back to the 19th century have supported this conclusion [5, 6]. It was discovered by Fama and French that the momentum phenomenon applies to small capitalization stocks as well as to markets around the world [7].

Momentum strategies can frequently experience substantial turnover, which could reduce the net returns [8]. Korajczyk and Sadka claimed in 2004 that momentum profits can be wiped out by transaction costs [9].

Environmental protection and energy security have drawn increasing attention as a result of the fast expansion of global economy. The new energy vehicle (NEV) is a powerful tool for easing the world's energy crisis, increasing energy efficiency, and lowering environmental pollution [10]. Current research has covered a wide range of NEV-related topics in depth. However, Wang et al. stated that there has not been much research on NEV enterprise stock price prediction, which is crucial for NEV enterprise equity financing, risk assessment, and policy formation [10].

This article focuses on Tesla's stock performance under the momentum strategy. This article researches the stock index data of Tesla and presents the research results of a momentum strategy in new energy vehicle stock. The rest part of the paper is organized as follows. Section 2 introduces the dataset and the methodology used to construct a momentum portfolio. Section 3 discusses the results from the momentum strategies and measures its risk and size positions. The impact of transaction costs is also discussed in this section. Finally, it concludes in the last section.

2. Data & Method

The data in this article comes from the Nasdaq index of Tesla, Inc. over the past few years, from 2011 to 2021, along with the WTI oil index in the same period. The article uses the daily adjusted closing stock index price, which fluctuates over time. Given the lack of a long historical time series, one needs to concentrate on shorter past returns.

Supposing that one has a return R_t in time series. $R\_(t+1)$ can be predicted in the following linear model.

$$R\_(t+1) = \alpha + \beta_{5D} f_t^{5D} + \beta_{1Y} f_t^{1Y} + \beta_{5Y} f_t^{5Y} + \varepsilon\_(t+1) \quad (1)$$

R_{t+1} is the return of the momentum portfolio. Here, ε_{t+1} is noise term, and the three factors are moving averages of the past 5 day, 1 year, and 5 year returns, each be normalized by the standard deviations of the corresponding returns to make the size of the predictors comparable [9]. Subsequently, the parameters of the model are estimated using linear regression.

$$x_t = \frac{\alpha + \beta_{5D} f_t^{5D} + \beta_{1Y} f_t^{1Y} + \beta_{5Y} f_t^{5Y}}{\gamma \sigma_\varepsilon^2} \quad (2)$$

At each time step, trade to the mean-variance allocation, with a risk aversion γ parameter which pins down the average size of the investment positions.

In the actual processing, one firstly figured out the daily return from the original data. Then all the operations are based on the values of this column. One knows that the simple moving average (SMA) is the average price of a security over a particular period of time. Therefore, to obtain the value of the simple moving average of n days, one just used the sum of the return on n days and divided it by n. As for the residual, it can be processed in several steps. Firstly, one multiplied the SMA for different period of time by their corresponding β and took their sum. Subsequently, taking the return of the next day minus α and minus the sum one just got, thus one gets the root mean square error (RSME) by dividing N minus the number of variables plus one into the sum of squares of residuals. The N refers to number of residuals.

All the data processing steps was carried out in Excel. According to the formula which is for the value of X_t from the question, one obtains this column. Afterwards, one obtained the strategy return from multiplied the return by X_t minus X_{t-1}.

3. Results & Discussion

In this study, the Tesla in SP500 is chosen, which with high volatility and WTI oil index as our assets. It is set that the risk aversion γ=3 at the beginning. Firstly, the momentum strategy on TSLA with 1-day lookback period is applied.

In this model It is set the data in 2011-2015 as the training dataset. Then, the 2016-2019 is chosen as sample. According to the analysis and calculations, the sharp ratio in sample is 36.18%, the sharp ratio out sample, which is in 2020-2021, is 36.98%. Besides, the maximum drawdown equals 1.29%. The results of the price trend are shown in Fig. 1.

Secondly, the momentum strategy is adopted on TSLA with a longer lookback period, which is 60 days. In particular, one chose risk aversion $\gamma = 10$ in this case, because the size of the investment will be too massive if keep the $\gamma = 3$. Choosing 2016-2019 as sample after the training dataset in 2011-2015, the sharp ratio in sample is 18.86%, the sharp ratio out of sample, in 2020-2021, is 32.41%. One has a maximum drawdown equals 44.98%. The results of the strategy is illustrated in Fig. 2.

In addition, one calculated how the strategy works on WTI with 1-day lookback period. Choose 2016-2017 as sample, the sharp ratio in sample is 3.24%, the sharp ratio out of sample is -1.98 %. One did not use this dataset in our comparing part because this is not ideal. Then, this study investigated the impact of transaction costs in momentum trading. It is found that if trades incur a transaction cost equal to 0.1% of the money amount traded, the Sharpe ratio of the strategy will be affected to a certain degree. The extent of the impact by transaction cost can be affected by the length of lookback date period.

It is set a transaction cost equals to 0.1% of the dollar traded. In our example, in TSLA 1-day lookback strategy, the sharp ratio in sample with transaction cost is 35.05%, and the sharp ratio out sample with transaction cost is 36.35%, comparing to 36.18% and 36.98% without transaction cost. One can observe that this impact is not obvious. Investment income will not be significantly affected.

When one has a longer lookback period, for example, 60 days, the impact will be more evident. The sharp ratio in sample with transaction cost is 18.45%, and the sharp ratio out sample with transaction cost is 10.10%, comparing to 18.86% and 10.19% without transaction cost. Nevertheless, one considers that if the sharp ratio is being very small, the transaction cost will affect the return on investment.

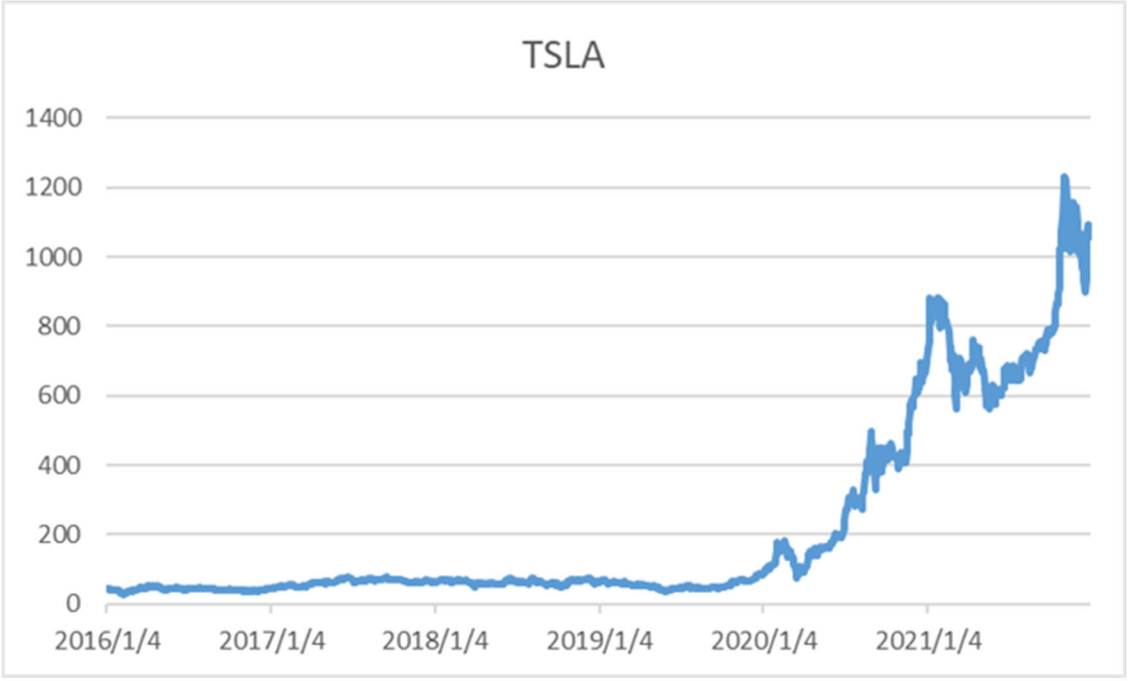

Fig. 1 TSLA results with 1-day lookback.

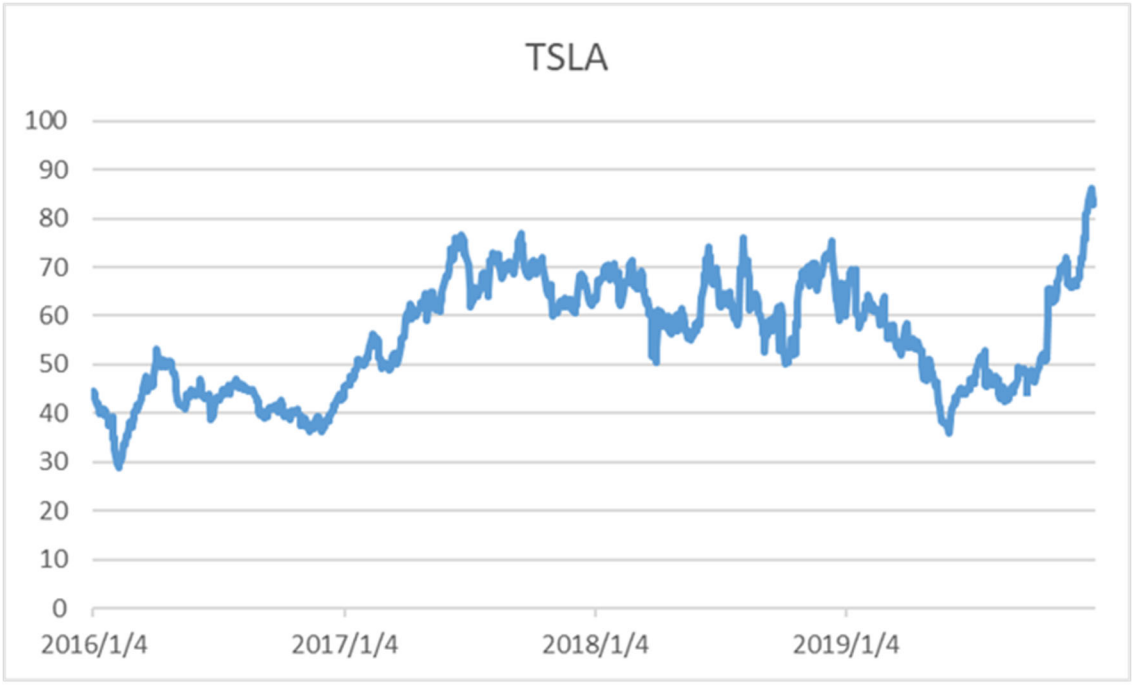

Fig. 2 TSLA results with 60-day lookback.

The amount of trading required to implement the strategy can be reduced. One can reduce the number and frequency of transactions to reduce the transaction cost. A balance can be found in a certain strategy for a certain kind of market between high transaction frequency and transaction costs. Then the data of Tesla was used to do the comparison. In the comparison, one changed the data of lookback period, investment date and risk aversion to look how the sharp ratio and cumulative performance will change.

As one changed the lookback period from 1 to 60, the sharp ratio changed from thirty-two-point four one percent to twelve-point seven two percent, and the cumulative performance changed from six hundred and sixty point seven two to one hundred and two point one seven. When one changed the lookback period, one find that the allocation x_t-x_t-1 has become maintaining a longer period of positive or a longer period of negative from initially fluctuating back and forth between positive and negative. This means that one continue to long or short over a longer period and are less sensitive to the ups and downs of the stock. This also directly leads to poorer performance of the strategy returns and ultimately to a lower Sharpe ratio and cumulative performance.

Fig. 3 TSLA results with 1-day lookback from 2020-2021.

Based on whether the stocks start to grow significantly, this study uses the data before the 2020 as my sample. It is found that the sharp ratio of in sample or out of sample is similar, about thirty six percent. However, the cumulative performance is much difference. In sample, the cumulative performance use 4 years to reach fourteen point eight, while out of sample, the cumulative performance just use 2 years to reach thirty-six point seven one.

Nevertheless, when one looked at the average and standard deviation, they shew much difference. So, one couldn't just look at the Sharpe ratio alone, but one also need to refer to other risk measures. Similar to this, greater risk volatility may lead to greater cumulative performance.

The last problem to discuss is risk aversion. It will just influence the cumulative performance. Just because you are more risk averse and long or buy less in the same situation, you will naturally make less or lose less. The central idea of the momentum strategy is that buy stocks when they went up and sell when they fell. The biggest characteristics of the momentum strategy is that it chooses the choice of the market. Focusing on what is happening in the market contributes to better grasp the market.

4. Limitations

The limitation of this paper is that only one stock is selected for analysis. In order to obtain more reliable data support, more stock index of NEV manufacturer should be added to this research. The research of the transaction cost lack of quantitative analysis and data support. With the support of more data from other NEV stocks such as NIO, this research can be more valid. In the future, it is encouraged to clarify the uniqueness of these stocks, which affects the performance of momentum strategy in these stocks.

5. Conclusion

In summary, this paper investigates the feasibility of momentum strategy in the NEV stocks with the sample of Tesla. The existence of the momentum strategy in this stock is verified in this article. In different length of lookback periods, the sensitiveness of the strategy return to the stock market volatility will be different. The transaction cost has some influence on the momentum strategy return, which is reflected in the affected Sharpe ratio of the strategy. The single stock of Tesla chosen for the study in this paper poses a limitation, more data from the market is needed. The transaction cost research is lacking in quantitative analysis and data backing. The significance of this paper is to have a deeper understanding of momentum strategy. In addition, the NEV manufacturers is a worthy object to research because new energy sources are replacing fossil energy sources nowadays. These results shed light on guiding further exploration of momentum strategy.

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